

In-situ/Operando Soft X-ray Spectroscopy of Photosynthesis and Catalytic Reactions

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To understand and ultimately control the interfaces in energy conversion and energy storage application calls for in-situ/operando characterization tools. Soft x-ray spectroscopy may offer some unique features. This presentation reports the development of in-situ reaction cells for soft x-ray spectroscopic towards the studies of photosynthesis and catalytic reactions over the years at the Advanced Light Source. The challenge has been that soft X-rays cannot easily peek into a high-pressure catalytic cell or a photoelectrochemical cell (PEC). The unique design of the in-situ cell has overcome the burden. Some of the instrumentation design and fabrication principle are to be presented, and a number of experimental studies of nanocatalysts are given as the examples, also the recent experiment performed for studying the hole generation in a specifically designed photoelectrochemical cell under operando conditions. The oxygen valence band signature was recorded while tuning the PEC parameters, two different types of holes in the valence band near the Fermi energy are identified.